

# Nanostructured Self-Healing Surface Films

Hong Liang  
Mechanical Engineering  
Texas A&M University

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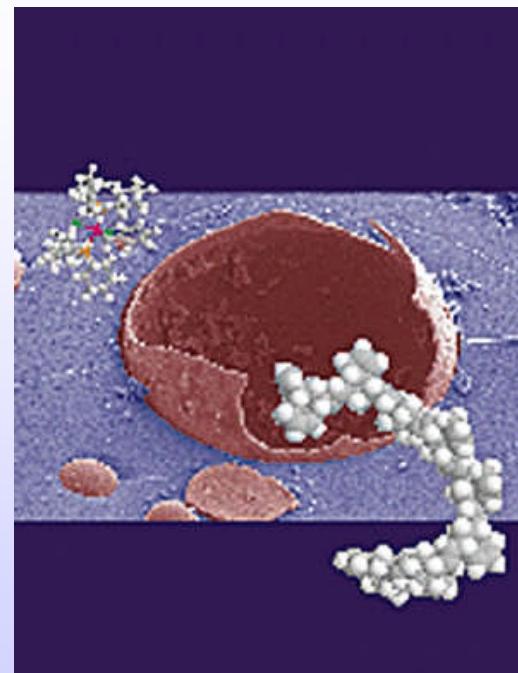


# The Healing Power of Materials

- Plastics
- Metals
- Concrete
- Paint



Polymers



*White et al., Nature, 2001.*

# Concrete



*Blauwe Brug, 1884.*

# Paint



*Nissan' self healing coating.*

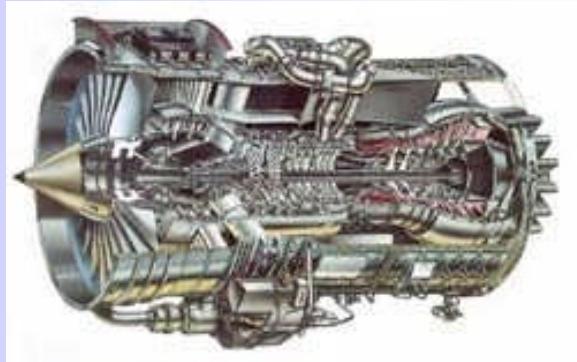
# Self Healing Metals

Nature's Role:

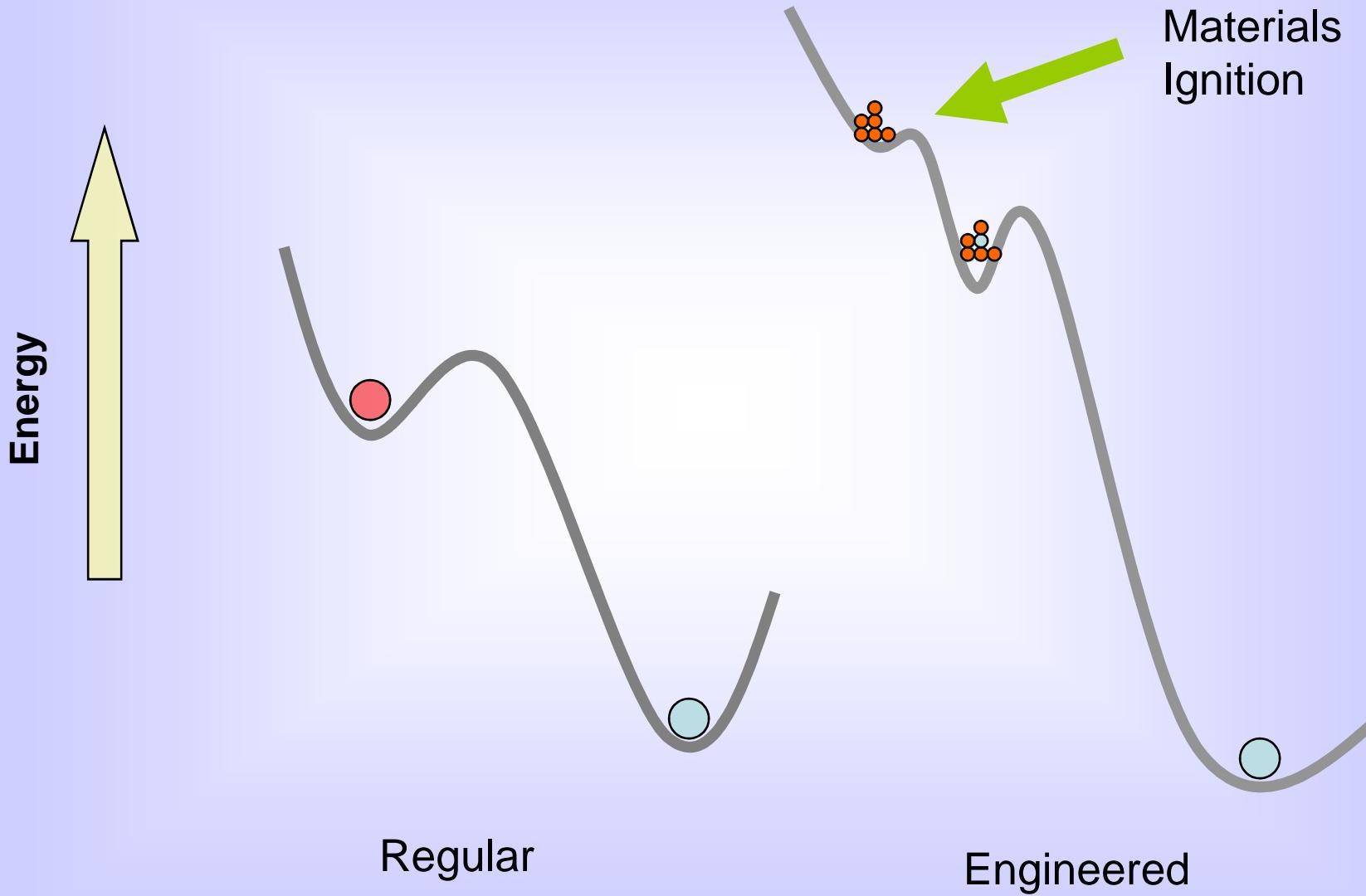
the more stable a metal is,  
the longer it lasts.

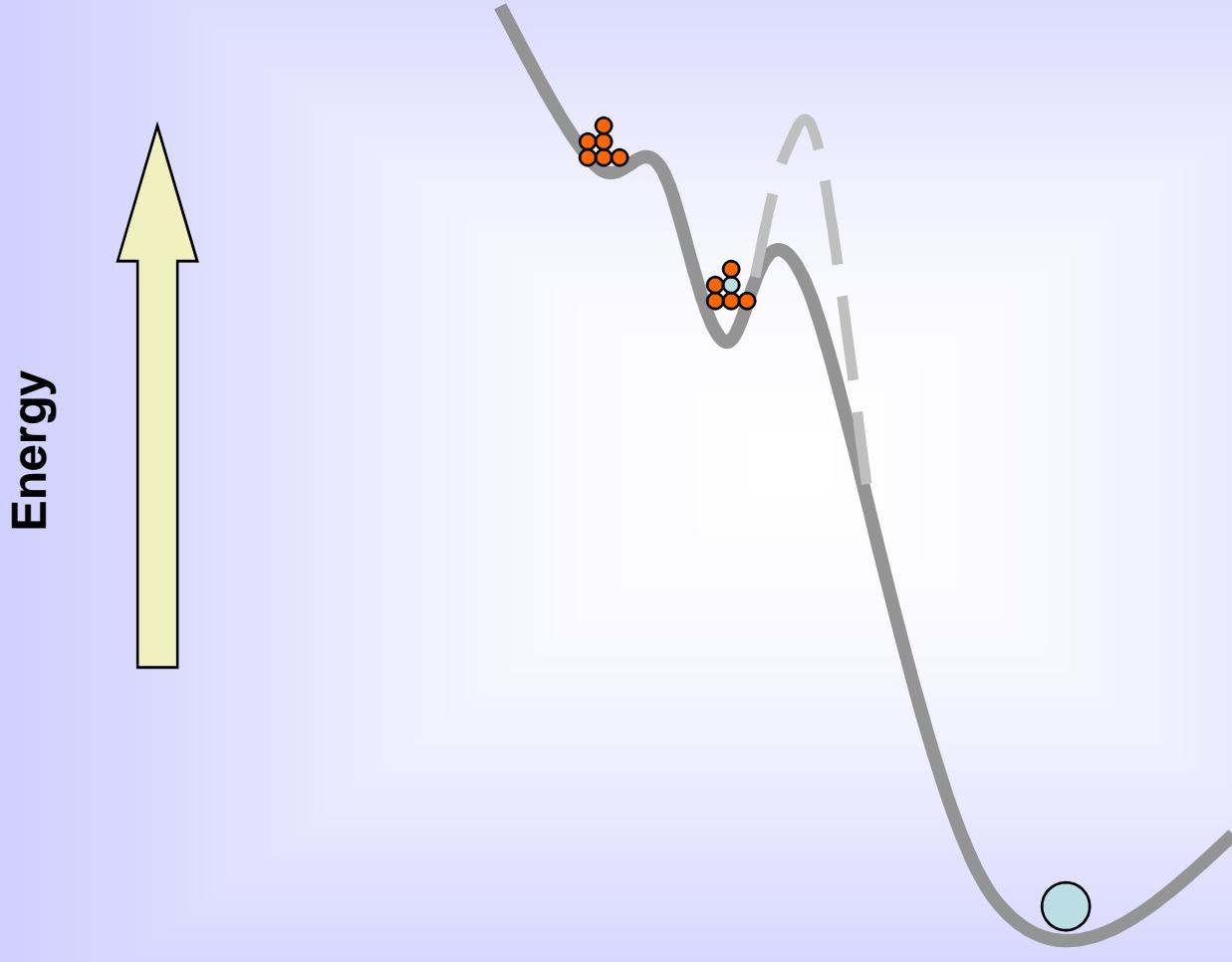
Engineered Role:

Use less stable metals to  
heal cracks and fatigue.

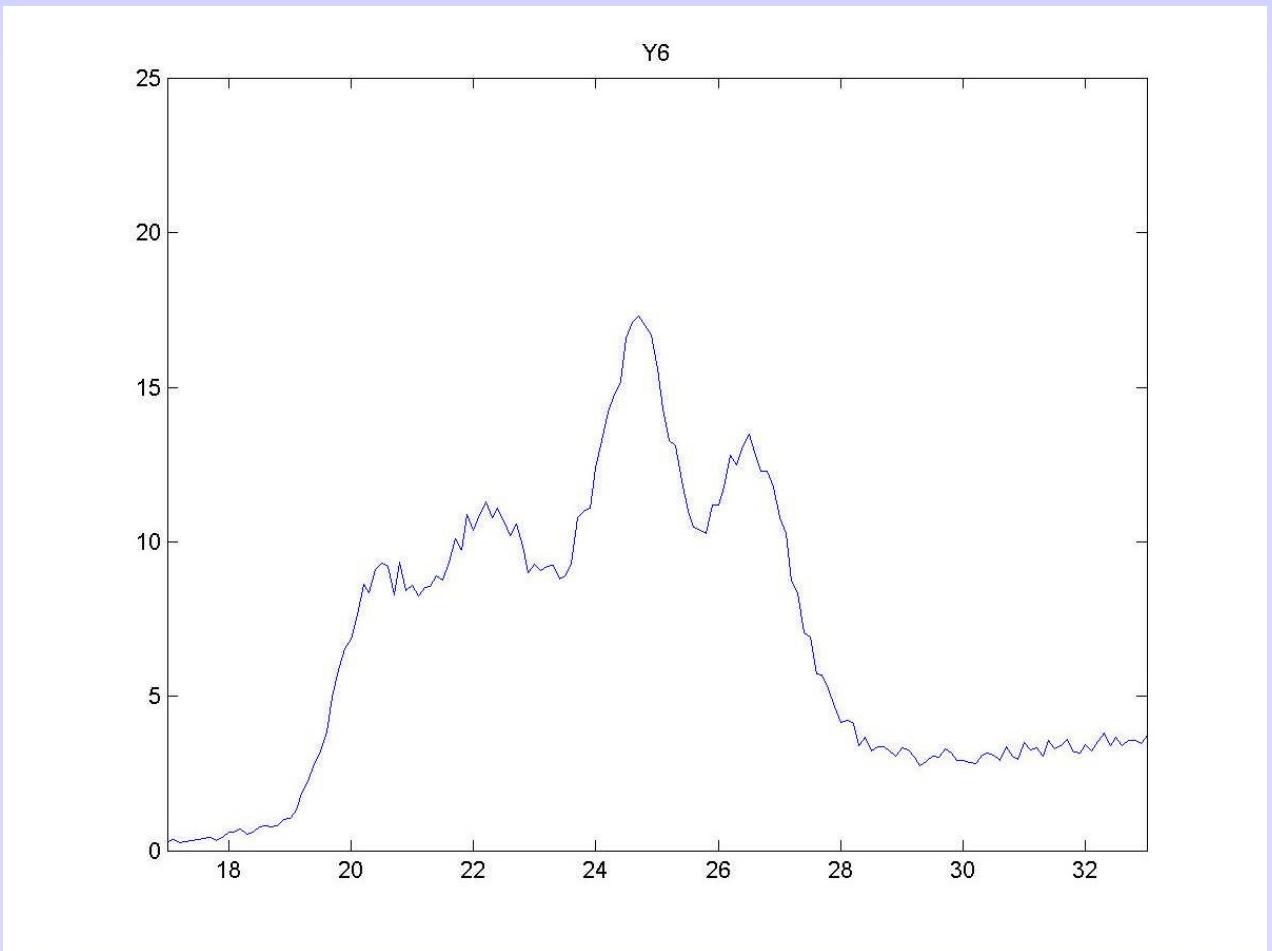


Al - Cu + Ag  
CSIRO  
*Monash Univ.*  
*Delft Univ. Tech.*



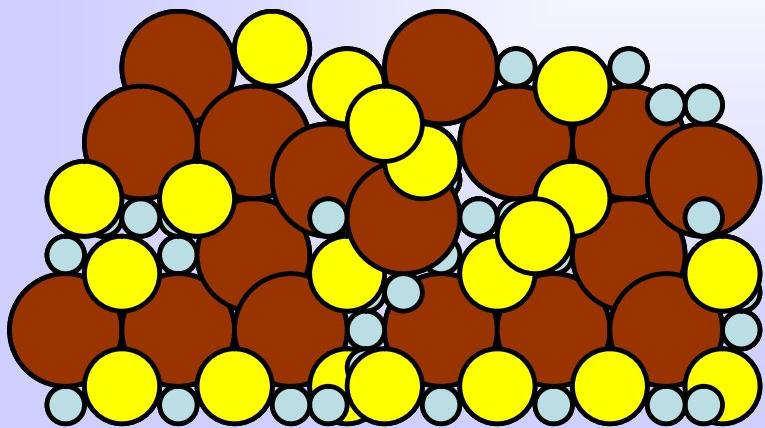
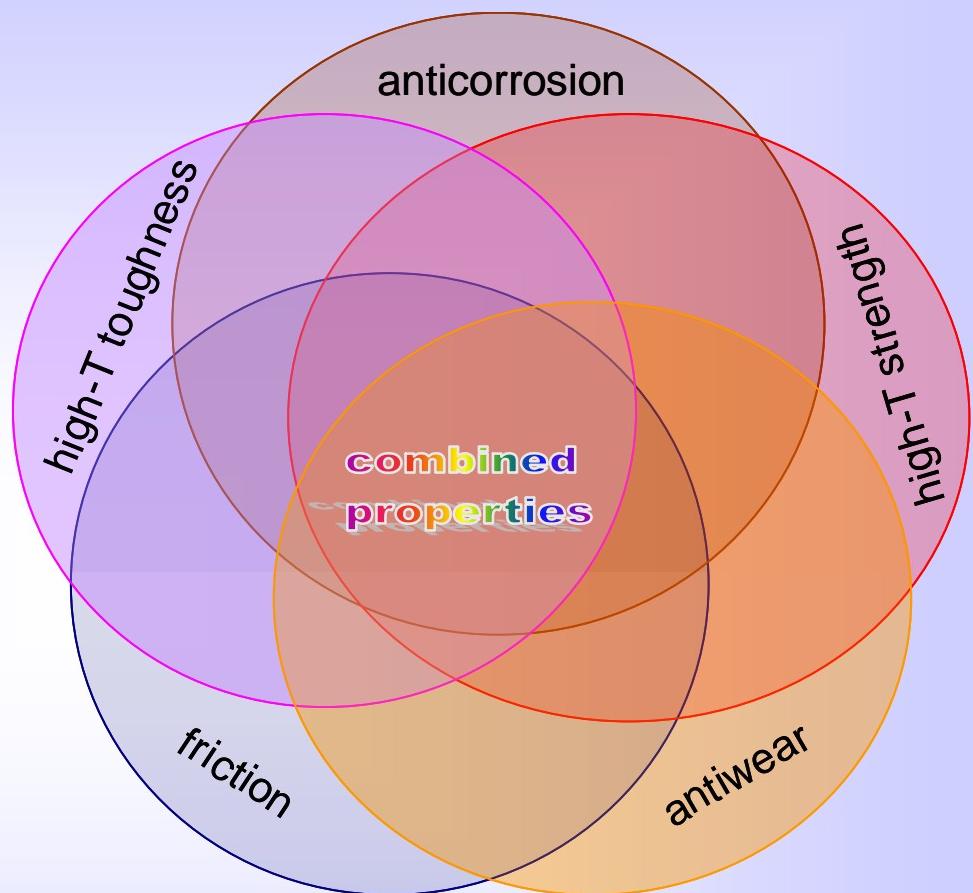


To increase the stability..

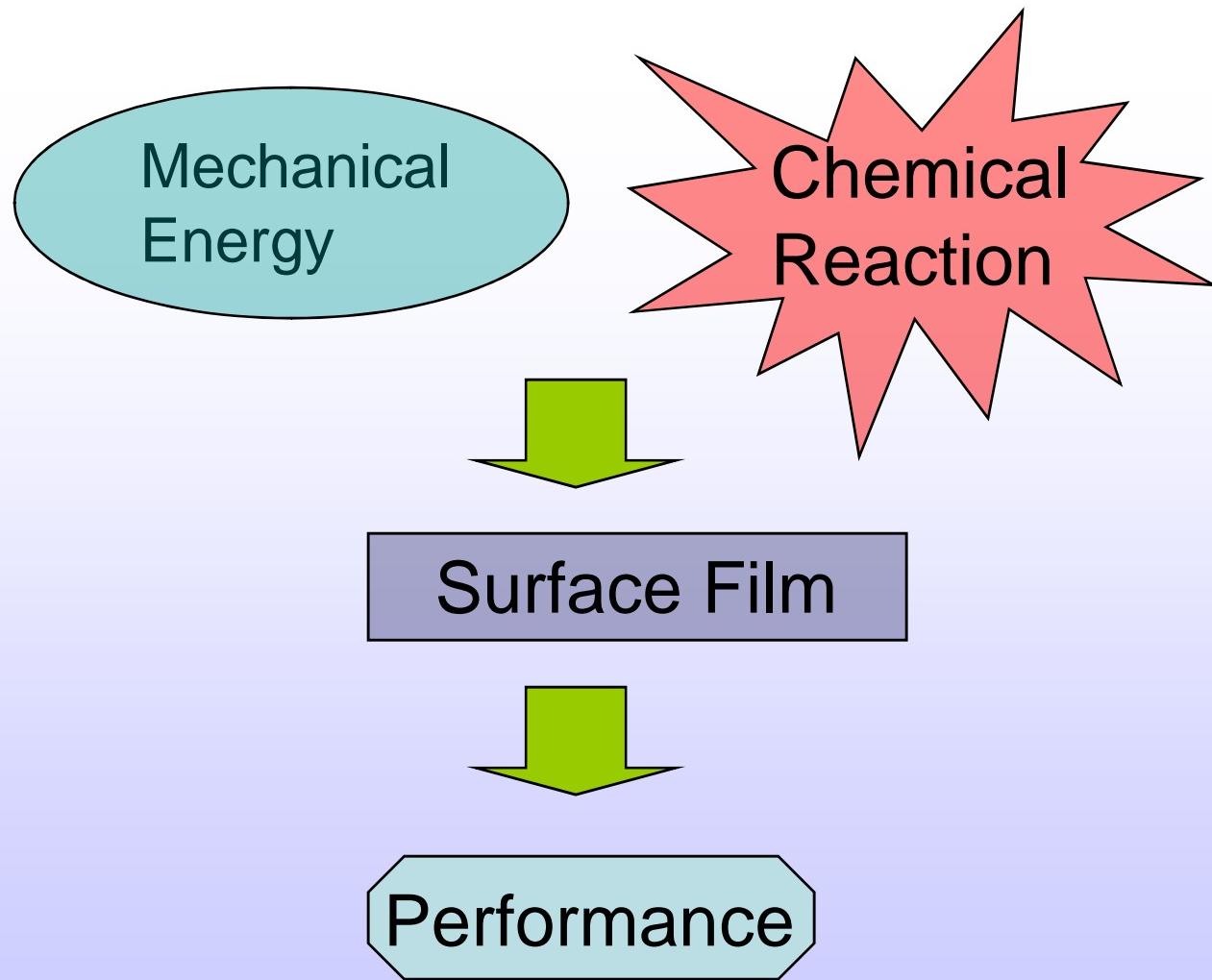


Materials are more active than we expected.

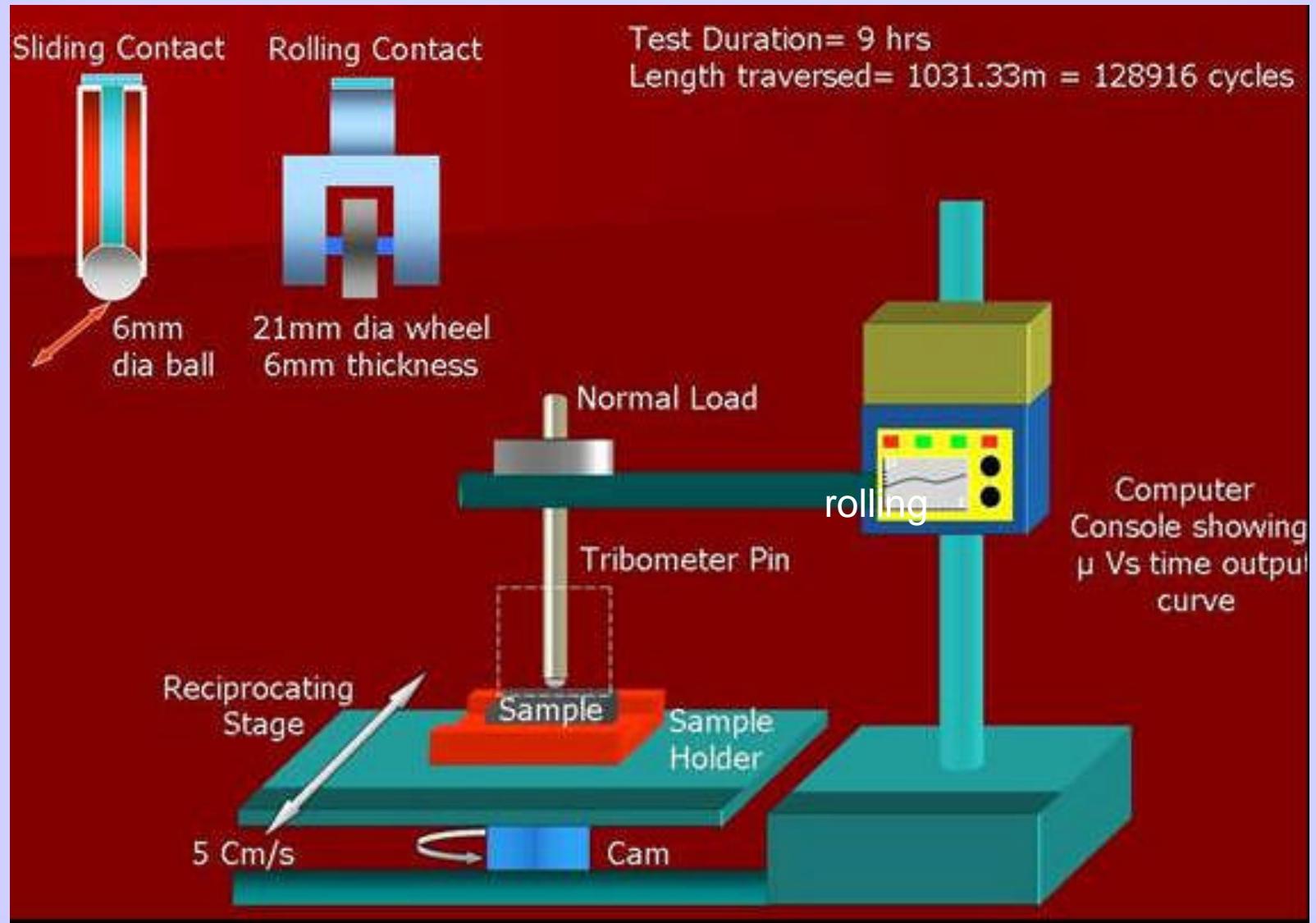
# Goal



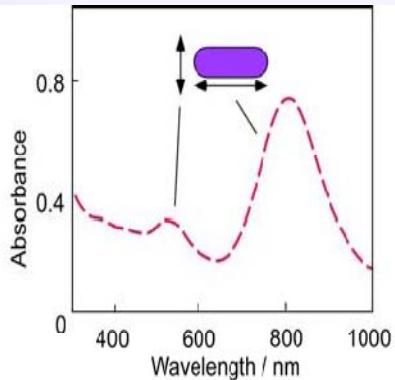
# Approach



# Experimental Setup

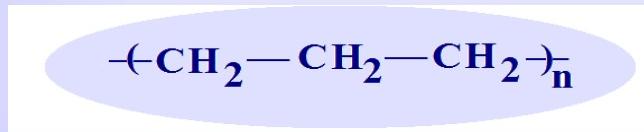


# Materials:



Periodic Table of the Elements																	
IA		IIA								VIIA						O	
1	H	3	4							5	6	7	8	9	O	10	He
2	Li	Be	11	12	21	22	23	24	25	26	27	28	29	30	31	32	18
3	Na	Mg	19	20	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	Ar
4	K	Ca	37	38	39	40	41	42	43	44	45	46	47	48	49	50	36
5	Rb	Sr	55	56	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sb	Xe
6	Cs	Ba	56	57	72	73	74	75	76	77	78	79	80	81	82	83	86
7	Fr	Ra	87	88	+Ac	Rf	Ha	Sg	Ns	Hs	Ir	Pt	Au	Hg	Tl	Pb	At
* Lanthanide Series		58	59	60	61	62	63	64	65	66	67	68	69	70	71		
+ Actinide Series		90	91	92	93	94	95	96	97	98	99	100	101	102	103	Lr	

# Vehicles:

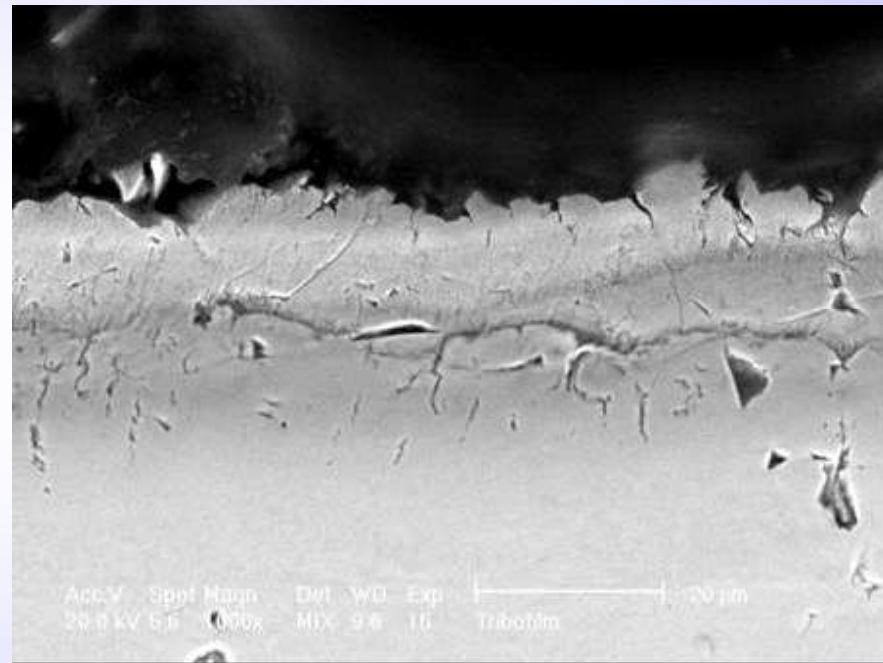
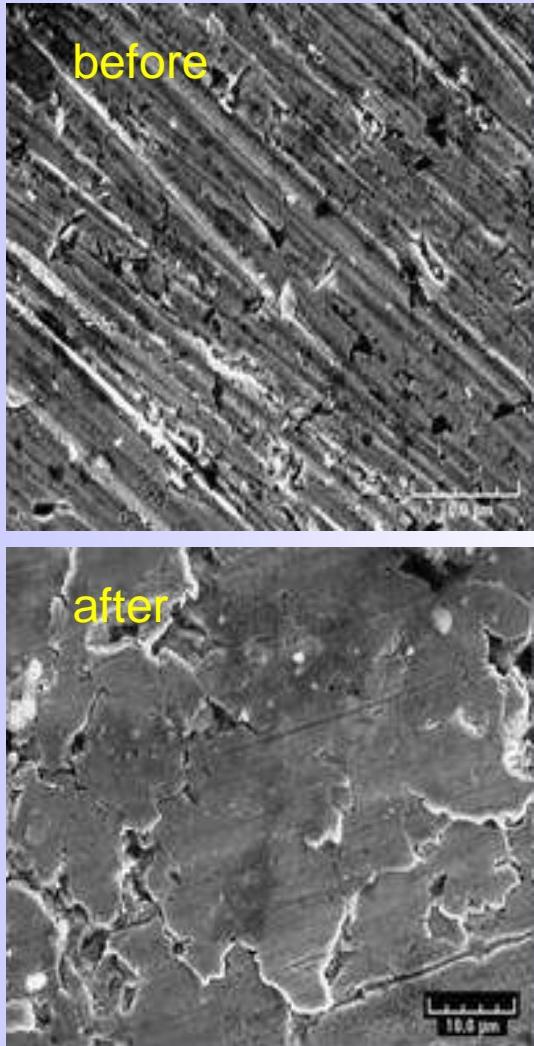


Mineral Oil Chemical Structure



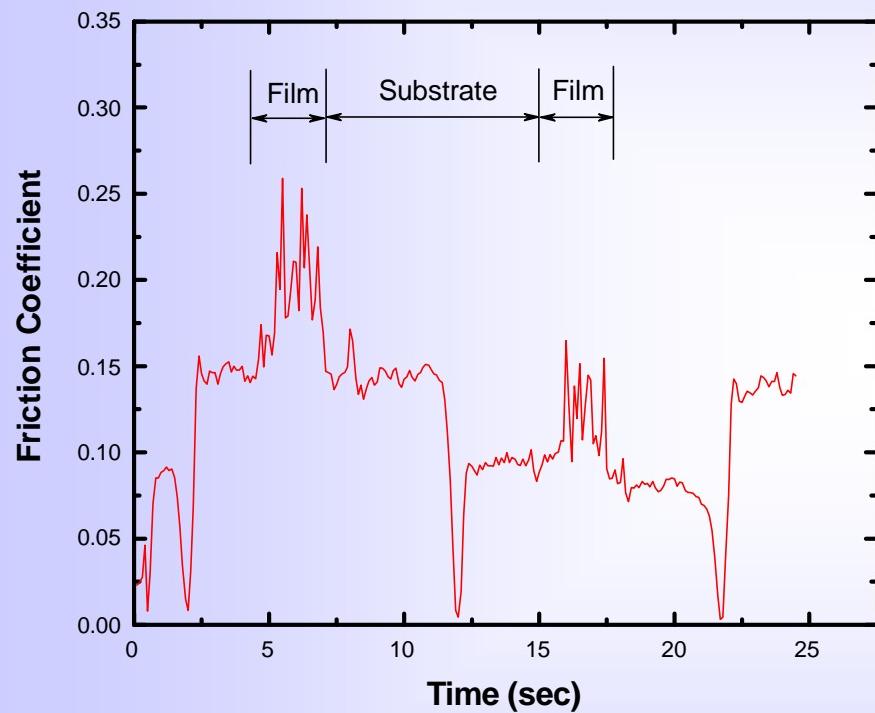
PEG Chemical Structure

# Track Surface

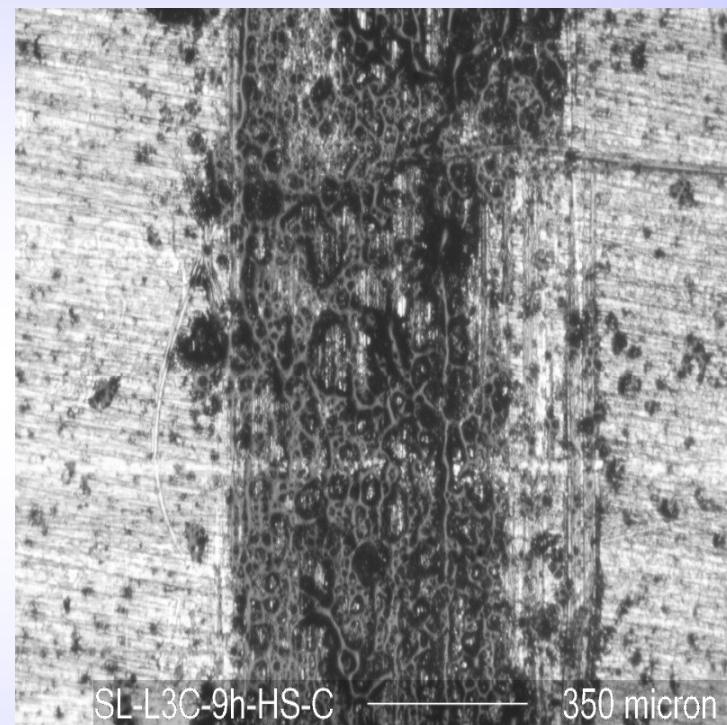


Cross Section

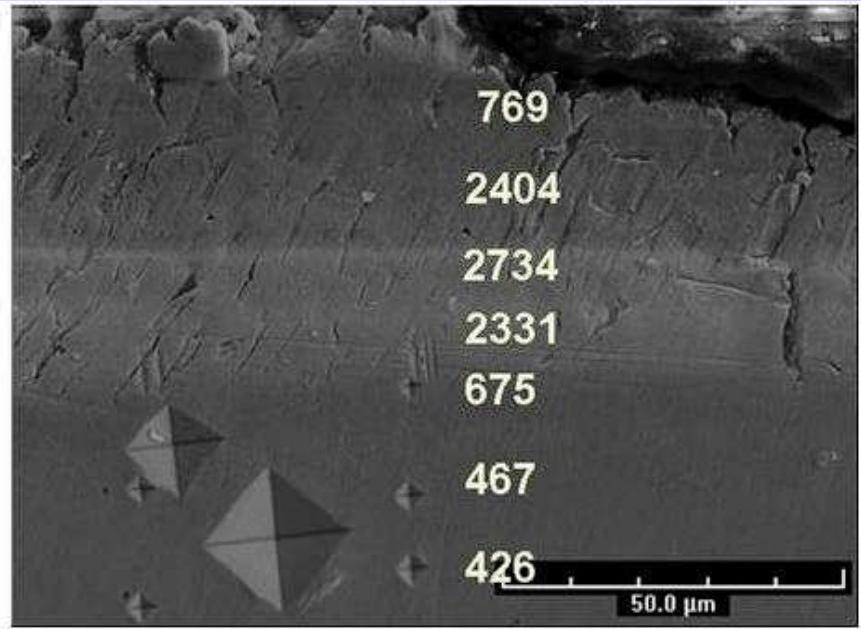
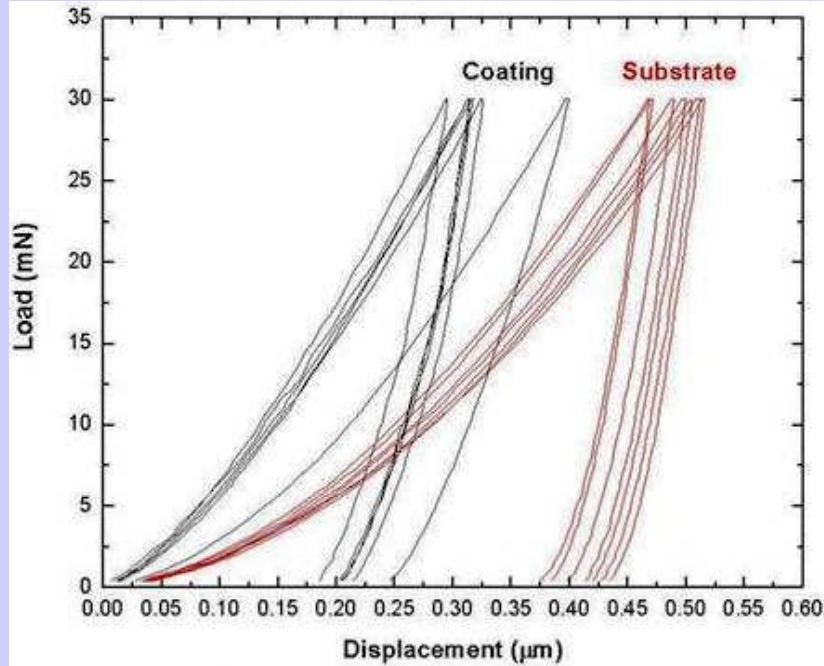
# The film is wear resistant



Scratch tests

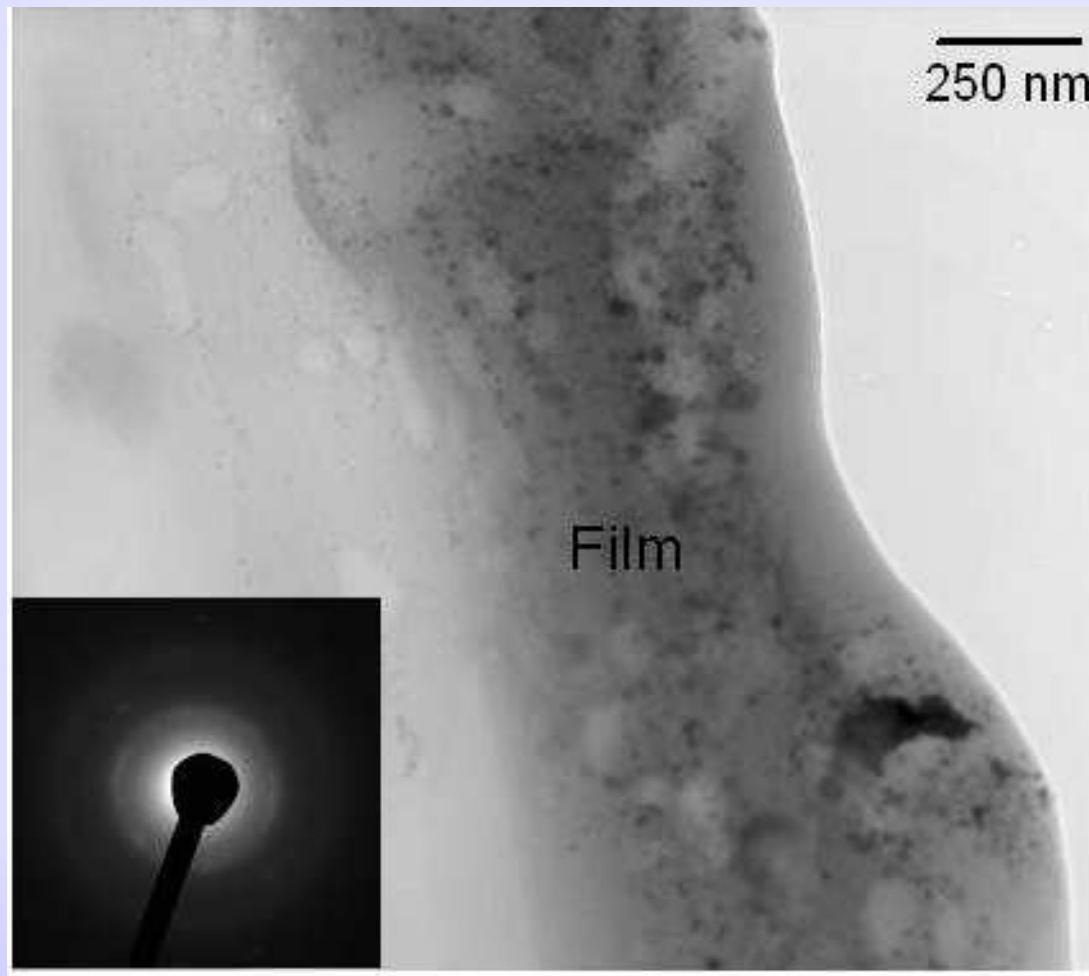


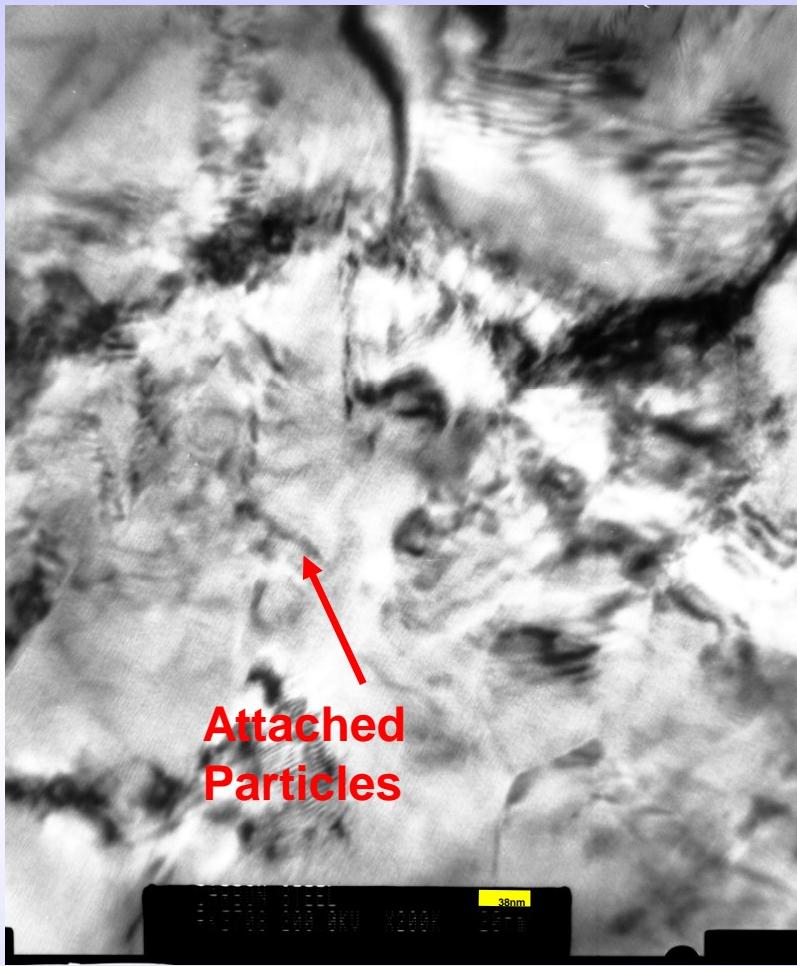
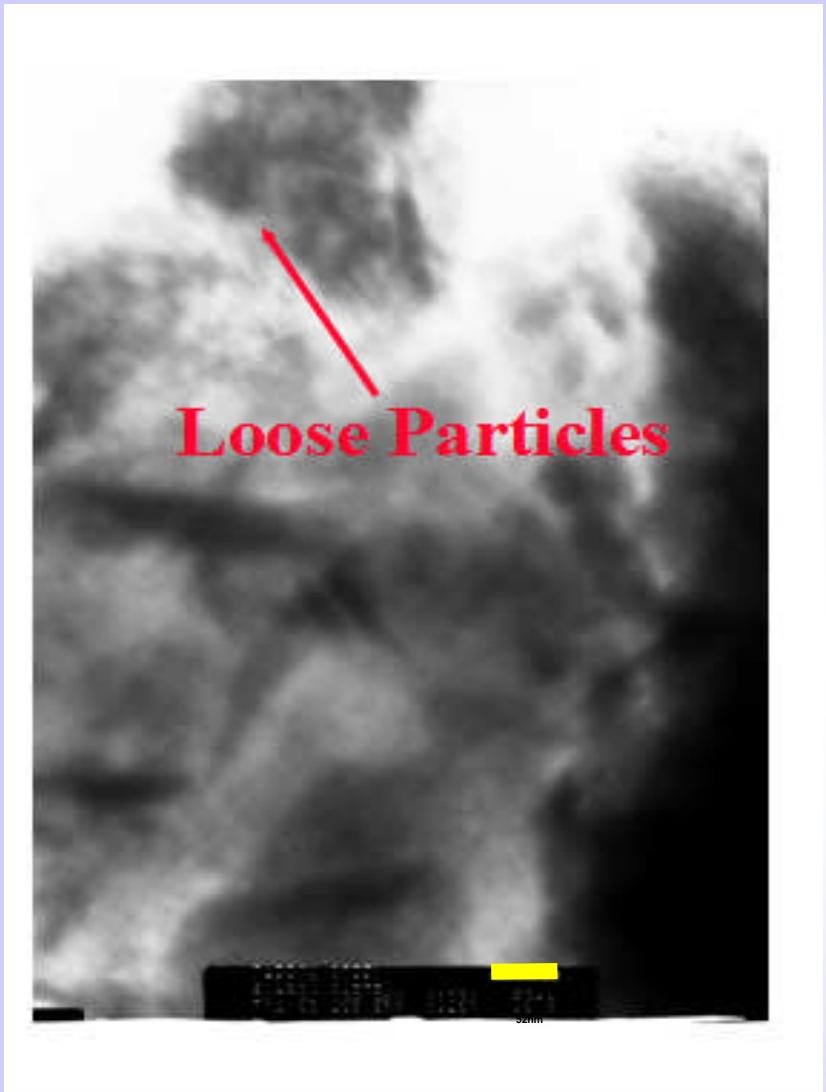
Wear tests



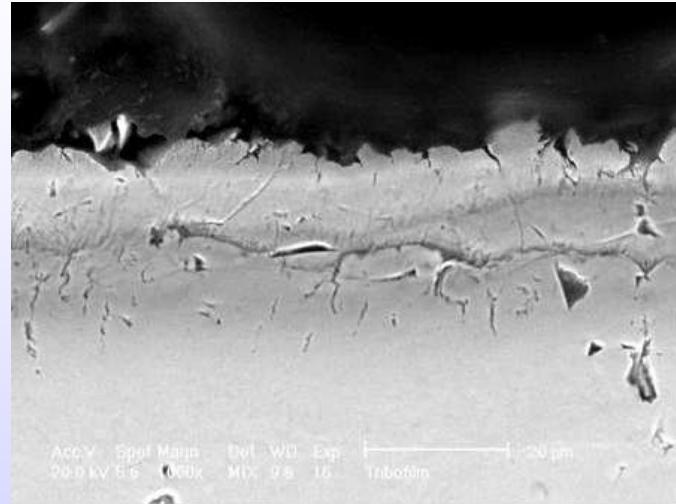
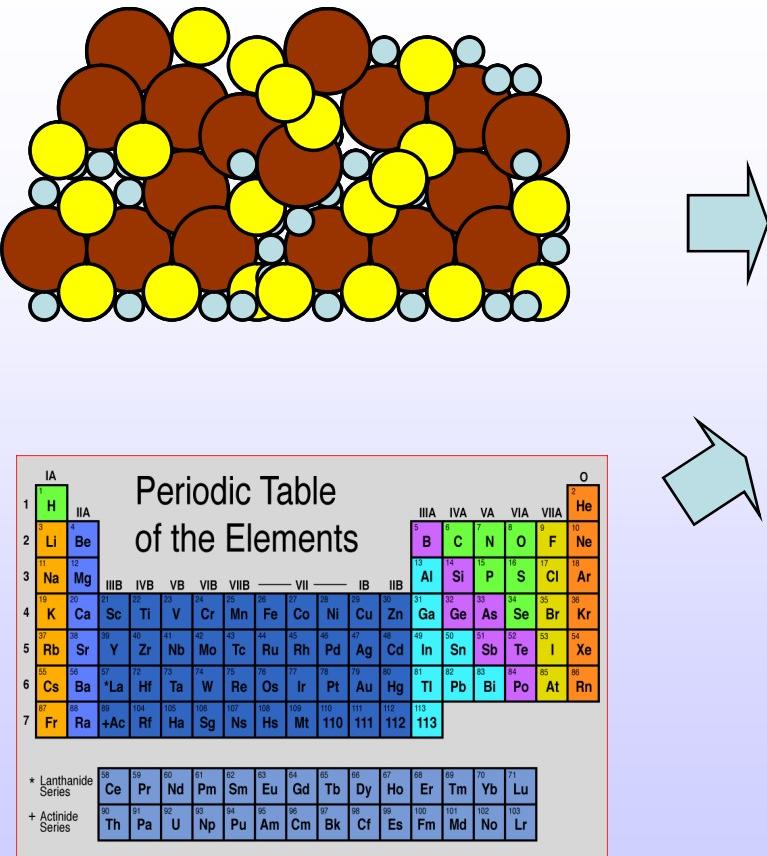
Microhardness of the film is more than five times of that of the substrate

The film is made of nanostructured/amorphous layer



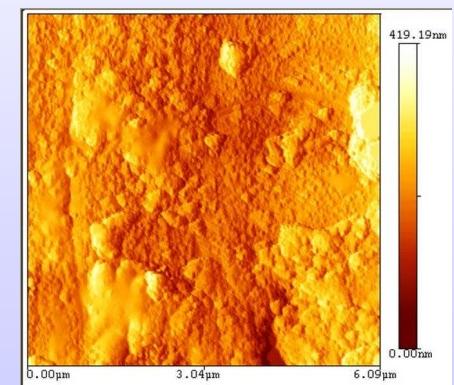
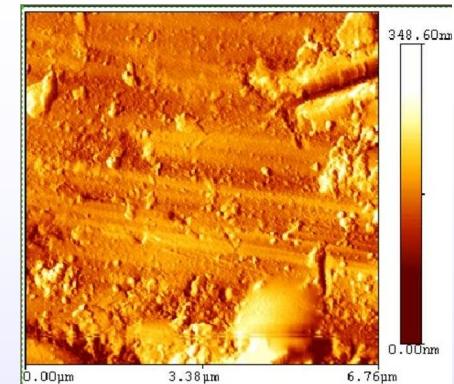


# Summary



# Summary

- Mechano-chemical process to form a surface film.
- Mechanical energy is highly controllable.
- The film can lubricate, self-repair, maintain, and extend materials' service life significantly.



AFM Micrographs.